Application of digital learning and interactive tools for boosting modern constructivist pedagogies case of western Algerian Universities

CHIB Djazia Amina [1*], ZINE Younes [2]

[1] Tlemcen University (Algeria) , djazia.chib@univ-tlemcen.dz
[2] El Oued University (Algeria) , zine-younes@univ-eloued.dz

Abstract:

In view of the technological changes with the tools and teaching methods used, e-learning has become a priority and challenge for the University of Algeria. This article recommends the use of basic teaching principles, which take into account the broad teaching principles of scientific content, visualization, and accessibility. And the feasibility of education, the humanization of education, awareness-raising and student participation. These principles have been modified to meet the needs of digital learning. Using quantitative methods as survey data collection to answer the research question, three main directions for the development of digital learning systems are proposed: constructivist teaching method; the degree of teacher-student interaction; and digital learning environment. The use of active teaching methods and the use of interactive tools to allow students to actively participate in learning has stimulated students' great interest and improved the quality of learning.

Keywords: constructivist pedagogy; boosting; digital learning; interactive tools; Algerian universities**.**

JEL Classification: M54.

Introduction

It is now well known that in order to provide effective professional services, teachers must not only be able to use new educational technologies (Moersch, 2002; Sandholt, 1997, Lemke, 2003), but also be able to use them for teaching content and general methods. In this regard, some authors recommend the use of technical teaching content knowledge (TPCK) to maximize its potential, emphasizing the positive impact of integrating these three dimensions on effective learning management. Process. (Koehler and Mishra, 2008; Mishra and Koehler, 2006; Graham et al., 2009). The concept of constructivism was introduced in the 1980s to improve student learning (Simons, Van der Linden, and Duffji 2000). This self-regulating structure is regarded as a very important variable (Shunk and Zimmerman, 1994; Wang, Haertel. and Walberg, 1990). The view closely related to constructivism is that a strong learning environment is needed to challenge and motivate students to become active and independent learners (Brown, Collins & Duguid, 1989; De Corte, 1990). The main feature of this so-called high-performance learning environment is that students acquire new knowledge and skills in real and challenging situations. The general idea is that students are more likely to become active, independent learners when possible. Personally understand which abilities help achieve meaningful goals, and which knowledge, skills and attitudes enable participants in important projects to take action effectively, expertly and professionally.The more learners directly understand which learning goals are meaningful, the more they tend to learn actively and independently. Among the educational technologies used in the classroom, digital learning technology has attracted more and more attention in recent years. (Spiers, 2008). The advantage of these educational technologies is that they can easily simulate real-world phenomena, thereby favoring more personalized learning paths (Spiers, Rowe, Mott, and Lester, 2011). Technologies have a positive impact on student learning because they involve students in an internally motivating learning environment (Foster, 2008; Papastergiou, 2009). So, how could the application of digital learning and interactive tools enhance the modern constructivist pedagogies in Algerian universities?

What is the role of strategic vigilance and monitoring O/T system in the success of start-ups?

Literature review
1- Constructivist pedagogies in the modern context

The modern education environment is not just a digital format, the amount of information is increasing exponentially, and the education system cannot understand the relevance of every piece of information. According to Carlile and Jordan (2005), constructivism is a dynamic process in which small changes in knowledge construction can lead to such changes in general understanding. Therefore, the main role of constructivist teachers in teaching is to guide learners to create new information through exploratory activities, learners establish their own connections and draw their own conclusions (Martin, 2006). Martin also claimed that teachers will help students reconstruct information in a way that is credible and meaningful to them. Some modern teaching trends that have evolved from a constructivist perspective include learner-centered learning, which emphasizes cenrality of learners, and promotes independent learning through the use of coherent learning strategies and learning contracts (Carlile and Jordan, 2005). Student-centered learning includes standards such as formative assessment, research-based learning, professional classroom learning, comprehensive curriculum and student display, immersion and rotation of various learning activities. In addition, student-centered learning focuses on higher-level thinking and students as researchers, clear teaching and one-on-one tutoring, daily creative use and the application of ICT to encourage active learning and positive relationships. In addition, teachers need to be able to recognize the uniqueness of each student in the classroom and make educational plans based on their unique experience in the constructivist classroom. Constructivism uses process methods.The teacher's role in providing information has been reduced and replaced by the role of identifying and supporting students' own thinking and meaning. Teachers help students achieve educational goals, accumulate student knowledge, and enhance the interaction between teachers and students. Constructivist learning involves negotiation, in which constructivist teachers invite students to participate in decisions about their learning. In constructivist courses, special attention is paid to the interaction between students and teachers. Created an environment in which thoughts can speak, listen, and exchange experiences. With the development of constructivism, teachers can create a classroom environment where learners become autonomous learners. Attempts to revive the learning process through the concept of "learning by doing" give way to small improvements, because it has been shown that student "actions" are rarely accompanied by a deep understanding of what they are doing (Alberts, 2000) . The memory paradigm needs to be replaced by the

understanding paradigm. In addition, modern students need to have life-long learning skills to ensure career success for decades after graduation. Therefore, the education system needs to consider two important issues: a) lifelong learning ability, and b) the formation of great scientific ideas as the basis for a greater degree of personal intellectual and professional development (Harlen, 2010).Let us make readers get used to the basic principles of constructivist pedagogy. The core belief of constructivism is that knowledge is actively constructed by students, not taught by teachers. The fact that students are not passive recipients of information is particularly important for the design of lifelong learning. There are two types of constructivism: 1) Cognitive constructivism believes that students form knowledge separately based on past experience and new information, so knowledge is the result of personal efforts. In this case, the educational environment must support and meet the needs of students, provide various resources and training activities. 2) Social constructivists believe that knowledge is the result of joint construction, and learning is an interactive process of information exchange, negotiation and discussion among participants.

2- Interactive tools and digital learning that aid teaching

It is now well known that in order to provide effective professional services, teachers must not only be able to use new educational technologies (Moersch, 2002; Sandholt, 1997, Lemke, 2003), but also be able to use them for teaching content and general methods. In this sense, some authors suggest using the knowledge structure of technical teaching content and emphasize the positive impact of integrating these three dimensions on the effective management of the learning process (Koehler and Mishra, 2008; Mishra and Koehler, 2006), S Graham et al., 2009) Although there are more and more ICT-based teaching materials and teachers have a broad understanding of the importance of using ICT-based teaching methods (Khine, 2001), relatively few teachers have used that. The method is applied to work in their teaching profession as actual training. The lack of professional knowledge and skills of teachers can explain the insignificance of the introduction of ICT-based teaching materials in the educational context; however, a large number of studies have shown that teachers' beliefs and attitudes towards these methods also have a decisive influence on whether and how they are used in the classroom (Hermans , Tondeur, van Braak & Valcke, 2008; Wang, Ertmer and Newby, 2004 Ertmer, 2005). Higgins and Moseley (2001) showed that teachers' perceptions of the effectiveness of the constructivist approach to educational activity design and management have a significant impact on whether and how teachers use

ICT-based learning tools in their work. However, other researchers have shown that teachers using a student-centered approach in the classroom can more effectively integrate their technical, educational, and content knowledge (Honey and Moeller, 1990). Due to the complex relationship between technology, pedagogy, and content dimensions, their use is usually more technology-centric (Harris et al., 2009). Mayer (2014) uses three hypotheses based on the cognitive theory of multimedia learning to describe why learning with digital tools is beneficial. : According to the dual-channel hypothesis, students can divide information into two different cognitive structures, namely visual and auditory channels.The second hypothesis is that the ability to process information in the channel is limited, so it is conducive to the learning environment to stimulate the activation of the visual and auditory channels to avoid cognitive overload. This is possible, for example, by presenting sound images or spoken text and written Or a combination of visual images. The third hypothesis is that students need to actively participate in learning to understand new information (Mayer, 2014). This can be achieved by using an interactive learning environment in which the learner can positively and directly influence his or her own learning process. In other words, "the defining feature of interactivity is the ability to respond to student behavior while learning" (Moreno and Mayer, 2007, p. 310). It is also divided into dialogue, control, and manipulation: dialogue means that students receive additional information or comments about their interaction as required. Controlled interaction occurs when students determine their personal learning speed or preferred presentation sequence. Finally, learners can interact with the learning environment by manipulating the presented information.This means that he or she can "control all aspects of the presentation, such as setting parameters, zooming in or out, or moving objects on the screen before starting the simulation" (Moreno and Mayer, 2007, p. 311). Studies have shown that the use of digital tools is particularly important in technology-related disciplines such as mathematics (for example, Gunbas, 2015), physics (for example, Chang et al., 2008), and biology (for example, Buckley et al., 2004). Improve learning and teaching) or chemistry (e.g. Frailich et al., 2009).We will use the statistical methodology and data analysis method to illustrate the potential of digital tools for teaching and learning in these subjects, taking into account that there are certain differences in the teaching and learning processes in these fields.

3- Methodology

This research investigates students' views on the use of digital learning and interactive tools to improve contemporary constructivist pedagogy in Algerian Universities, and determines the relationship between constructivist pedagogy and the level of teacher-student interaction; and digital learning environment. Using quantitative methods as survey data collection to answer the research question. The target group is undergraduate and graduate students who have completed courses in economics, management, finance, biology, and technology sciences disciplinary. A total of 344 students from Tlemcen, Oran, Mostaganem and SIDI BELABES from the Western University of Algeria were selected. We performed principal component analysis using the Varimax rotation of variance to determine the subscales of the 52 items in the questionnaire: 10 determined factors explained 52.8% of the total variance. In terms of content, this grouping only partially corresponds to certain factors: in some groups, we group together elements related to various factors. To assess the differences in student experience, we divide the scores into 5 thematic groups or topics based on content. The first group of "difficulties and advantages that may exist in e-course learning" includes 11 points, and the second group of "attitudes towards interactive tools and digital learning" also includes 11 points. The third groupe with total of 7 concern the use of dishonest digital learning strategies to test students' independence and case-solving skills. The fourth group with total of 10 related to learning independence and engagement . The Cronbach's alpha coefficient for master's or bachelor's thesis or graduation is shown in Table 2.

Table number (01): Demographic information on Intervention Groups students

Demographic parameter		G1 (Master's level)		G2 (Bachelor's level)		p-value
Parameter	Category	Count	%	Count	%	
Sample size	N	164	100	180	100	
Program track/field		economics, management, finance, biology and technology sciences				
Completed e-course		All e-courses		All e-courses		
Gender	Male	29	17.6	35	18.7	0.884
	Female	132	82.7	148	81.5	

Age	Under 20 years old	0	0	32	16.8	0.000
	20–25 years old	28	17.5	148	81.5	
	26–29 years old	21	13.2	3	1.1	
	30–34 years old	40	27.9	0	0.0	
	35 years old and over	72	44.8	1	0.6	
Employment	Currently not employed	28	16.7	98	53.0	0.000
	Work is related to the program track they participate	82	51.5	10	5.6	
	Work is NOT related to the program track they participate	51	31.8	76	41.6	

Source: Authors' by SPSS software

Table number (02): Alpha Cronbach's coefficients

N	Thematic group	Number of points	Cronbach's Alpha	Comment
1	Possible difficulties and advantages of studying at e-course	11	0.804	Good internal consistency
2	Attitudes toward the interactive tools and digital learning	11	0.748	Good internal consistency
3	Independence of assignments completing and testing	7	0.527	Weak internal
	and the use of dishonest strategies in online learning			consistency for 5 points
4	Learning independence and engagement	10	0.739	7 points are well consistent

5	Perceived practical usefulness of the e-course	3	0.731	2 points are well consistent

Source: Authors' by SPSS software

Our goal is to create two groups of students who will make up the majority of the sample, not on a specific topic but on each of the 5 topics in order to express a series of opinions. Students can be divided into 2 groups based on a series of questions. Include in each topic, and explain the typical opinions of each group of respondents from the content. Considering the evaluation of each topic as a grouping variable, we adopted the method of cluster analysis. Divide students into two categories: larger (LC) and smaller (SC), and then we compare the distribution of answers for these two items. Look for differences. In this way, we identified many typical relationships of perceptual learning experience, which are characteristic of each group theme. We then compared the distribution of undergraduate and graduate students in these groups to understand which of these two categories dominates the LC.

Results and Discussion

According to the first theme "Difficulties and advantages that may be encountered in e-curriculum learning", they are divided into two groups: "Large" (LC, N 257) and "Small" (SC, N 87). Table 3 shows the response distribution of these groups (chi-square 48 p 0.000, p and <0.001) to the item "E-course preparation is convenient".

Table number (03): Comparison of the 2 distributions of answers to the point "It is convenient to preparefor classes using e-course" for 2 clusters according to Chi-square test

Cluster		It is convenient to prepare for classes using e-course				Total
		No	**Rather, no**	**Rather,yes**	**Yes**	
Large LC	Frequency	5	6	45	201	264
	% in LC	1,8%	2,4%	16,9%	76,9%	100,0%
Small SC	Frequency	0	10	42	35	80
	% в SC	0,0%	11,5%	46,2%	40,4%	100,0%
Total	Frequency	5	16	87	236	344
	% in total	1,5%	4,7%	25,3%	68,6%	100,0%

Source: Authors' by SPSS softare

Table 3 shows that compared with SC, the proportion of absolute positive responses (77% vs. 40%) is clearly dominant in LC, but the proportion of "sufficiently positive" responses (16.9%) is significantly lower than that of (46%) and The "opposite" is slightly lower (2% vs. 11%). There are almost no negative comments (2% vs. 0%). When comparing the 11 parameter sets of the first topic, the complex results of the two groups are shown in Table 4. If the ratio between the properties of a given reaction in the LC and SC groups differs by more than 10%, it means its value, and if it is less than 10%, it is marked as "equal". For example (see Table 2) LC respondents gave 36% more "yes" answers, 29% less than SC respondents' "quite yes" answers, and "actually no" (less than 9%) and " The difference between "no" (more than 2% and less than 10%, so it is considered "same". Compared with LC respondents, the evaluation of the difficulties and advantages of learning e-courses is more typical. At SC, I most confidently expressed the recommendation to use the EC option for course preparation, denying the difficulty of training without the help of the teacher and the difficulty of personal time management, easy repetition, insufficient understanding, or lack of knowledge. Information in the E C. The research and other information provided to them. we think that the test can help them better remember the content of EC; at the same time, they often deny technical difficulties and adjustment problems and deny the complexity of learning without the help of a tutor. And only almost all of the two groups of respondents support the view that EC helps to track their personal development, there is no difference. The difference between LC and SC is only in the form of the answer. The general trend is that according to our ideas, sample students dominate when a specific group has a specific set of attitudes and falls into one of the categories reviewed. Since the master's level. The participation of G1 and G2 students in the cluster is significantly higher, and the attitude set has its own characteristics. There is no difference in the distribution of G1 and G2 students in the two clusters: 75% of graduate students and 74% of undergraduates belong to LC, 25 % And 26%-to SC or (adjusted chi-square continuity 0.003, p 0.957). This result contradicts the traditional assumption that it is more difficult for a Master's level to adapt to learning in a digital environment.

The problem is getting more and more serious, because computers, smartphones and the Internet are indispensable attributes in our lives. Most students use them in their professional activities. Why does it become more difficult to learn with their help? Examinations are ambiguous, but it is well known that examinations cannot be the only form of ability control; as students themselves have confirmed, examinations can and should perform

educational functions (Sorokova, 2020). We have the possibility to Implement that idea to realize the e-course. According to our experience, students' difficulties in independent study of courses are often related to unsuccessful frameworks and inadequate selection of course elements, teachers' lack of digital ability, teaching errors, and systematic lack of moderation. Compared with face-to-face teaching, courses that communicate in digital format and interactive environments are easier to obtain. The cluster analysis of the second topic "attitudes towards interactive tools and digital learning" parameters resulted in two clusters with different proportions of respondents in LC (N 240) and SC (N 104). Table 5 shows the generalized results of the 2 cluster comparisons of the 11 cluster variables in the second topic. There is no difference between the distribution of students at the two levels of education from the two clusters: the proportion of graduate students is 71% compared to 68% of undergraduates belong to LC, 27% and 32% belong to SC respectively (continuous chi-square adjustment = 0.384, p = 0.535). This is the general situation of LC students and SC students. Compared with traditional face-to-face teaching, among them, they are more interested in EC blended learning, and more than 40% of them are very positive about it. Most of them want to study other subjects in EC format. They confidently declare that they like this direction and it is time to take advantage of the e-course. They want to study EC at other universities in Europe and abroad. They disagree that EC will reduce the quality of education and make it more difficult to obtain. Most of them think that using EC can solve the problems of employed students, but they are less than students in SC. So, using EC is a necessity of modern life, although the proportion of the answer is definitely yes. Although the proportion of graduate students in the LC cluster is slightly dominant, the difference is not significant. More than two-thirds of the students at both levels belong to the LC, which in turn is different from thinking that the students are more experienced Master's degree students. Stereotypes are contradictory and skeptical. On the contrary, e-course is a modern trend for most people and opens up more opportunities for online learning in partner universities (including foreign universities). And the use of dishonest strategies in online learning can identify the following two groups of respondents: LC (N = 233) and SC (N = 111). The summary results of the two cluster comparisons of this set of clustering parameters are shown in Table 6. There is no difference between the two clusters: 66% of graduate students and 69% of undergraduates belong to LC, and 33% vs. 31% respectively to SC (Chi-square with Continuity correction ¼ 0.128, p ¼ 0.720).

3- Distribution of answers to the points of the 2nd topic "Attitudes toward the interactive tools and digital learning in a large cluster (LC) as compared to the small cluster (SC)

They are unlikely to deny that online test results are forged, but they tend to give a more cautious answer: "Maybe not." Few people are completely sure that the students are taking the test by themselves, and more than half of the classmates have completed the homework alone, but they are likely to agree with the final statement. LC mainly denies that extending the test duration or allowing multiple attempts to pass the test helps prevent dishonesty strategies, and less often but almost 70% of the time denies the need for strict control of students during the test. The last view seems to be self-contradictory. Why does strict control, such as camera or offline testing in front of independent observers in the classroom, not help solve the problem of dishonest strategy? Why can the restriction be bypassed? Or do students just don't want to control themselves? No matter what happens, some students are better at applying dishonest testing strategies in LC. It may reflect their own life experience, some kind of cynicism or frustration, but it can justify their own dishonesty strategy.The issue of dishonest strategies requires further investigation. For approximately two-thirds of LC's G1 and G2 students, there is no difference between the two. According to the 4th topic about learning independence and interest parameters, cluster analysis results in 2 clusters. LC (N = 195) and SC (N = 144) have a larger proportion of respondents than 3 previous cases. The generalized results of the comparison of 2 clusters and 10 parameters of the clusters of the fourth topic are shown in Table 7. Comparing the student distributions of the two test categories in the two clusters, it is the first time to find a statistically significant difference: 68.3% of master students, while only 47.8% of undergraduate students belong to LC, the proportion of students in the same two levels in SC They are 31.7% and 59% respectively (chi-square adjusted to continuity ¼ 14.571, p = 0.000).Learning independence, student participation, and interaction are very important because they partly reflect the success of the transition from a teacher-centered model to a student-centered model. 60% of students believe that they have studied in a seminar (or webinar). It is much stronger in the BL format. In traditional face-to-face training, there is no difference between groups. LC students often say that they study systematically from the beginning, and most of them deny that they did not start learning immediately. Students do not agree to limit their communication with teachers to forums or webinars. In addition, in their opinion, more than 90% of students have participated in the seminar, but at the same time they think that they have too little personal contact with the

lecturer. Contradictory, because blended learning means only canceling face-to-face activities, not seminars. Perhaps this is to some extent a manifestation of teachers who support the teacher-centered model imposing stereotypes. Reduce the workload of teachers in the classroom. In this case, worrying about losing personal contact between teachers and students may just be a rationalization of one's potential worthless fears.The first thing to do here is to develop teachers' digital skills and their ability to use active and interactive teaching methods, while changing the form of teachers' remuneration to a more differentiated training system seems appropriate stimulation. According to our experience, when teaching in a digital environment, the lack of personal contact between students and teachers is mainly due to the arguments of teachers rather than students. The design of an inverted classroom does not mean that there is a lack of interpersonal communication. The question is whether teachers can use the various possibilities of the digital environment to make the educational process interactive. This is an area to show their professional skills. The three points related to the perceived actual benefits of environmental courses are divided into two groups: LC (N 262) and SC (N 82).

Table 8 shows a summary of the results of comparing two clusters based on three cluster parameters. Comparing the distributions of the two levels of students in the two clusters, there is no difference: 74% of graduate students and 79% of undergraduate students. For LC bachelor's level: 26% and SC 21% (chi-square adjusted continuity 36 0.836, p = 0.361). More than 90% of LC students think that the courses are rich and have the hands-on ability, but compared with SC, they still don't know how to apply statistical methods and data analysis in their qualification scientific research , which may be due to that the third year undergraduate students and the second year graduate students have not done any empirical research before. The following are the percentages of LC and SC respondents relative to the total sample size (N = 344). Subject1 LC 75% and SC 25%; Second subject: LC 69% and SC 31%; Third subject: LC 68% and SC 32%; 4th Subjects LC 56% and SC 44%; and 5th subjects LC 76% and SC 24%. At the end of the questionnaire, students were asked to conduct an overall evaluation of the e-course, and provide comments and suggestions. Among the 344 interviewees, 180 (54%) gave the highest score to the course, believing that the quality of the course is high, thanking the teacher and not blaming it. Only 10 students (9% of the sample) did not comment or gave extremely negative reviews. One of the strengths of the course is its practicality: "When you study statistical standards, you will immediately think of what interesting research they can do with their help." They insist on the structure, clarity and accessibility of the topic statement, and Rate the

course as "entertaining, detailed and interesting". Students appreciate being able to "choose their own class time"; reject the possibility of face-to-face seminars, "if the student determines that he/she does not need them", and if regular full time attendance is due to illness or impossibility. "Stop meeting video recording, record some useful things, and restore to things they don't understand" technical ability. They said that this is "a high-quality degree and a high level, and it is a pleasure to study e-courses", "this degree is very useful for higher education and the entire profession", "I regret that there is no way to study earlier in the specified courses. The students pointed out They addressed the shortcomings and made some suggestions for improving the course. For example, they suggested making short video clips, improving course navigation, and introducing learning tasks outside of the control test instead of lectures. Like some of the suggestions contradict each other; such as, Some students felt that it was unnecessary to discuss self-paced topics with teachers in face-to-face classes, and suggested to spend more time solving cases in SPSS. Independent study because they used to study at university and did not encourage or control them at home. Wonderful student statement: "This e-course simply cannot be praised! Very clear and structured". "I think even fifth grade students will accept it and understand everything. After completing the module, I can almost easily pass the exam or solve the problem".

Conclusion

Examining the attitudes of course graduates towards different aspects of learning in the digital environment, two large clusters (LC) and small clusters (SC) can be identified for each of the five subject point groups that are considered as clustering parameters. Usually there are 2/3 to 3/4 of the interviewees, representing the majority opinion. Only when talking about the fourth topic, independence and willingness to learn, slightly more than half of the respondents belonged to LC. On the fourth topic, the proportion of undergraduates clearly exceeds the proportion of undergraduates: more than two-thirds to less than half. In the remaining four subjects, there is no difference between G1 and G2: about 70-75% of students belong to LC, and 25-30% of students in both groups belong to SC. LC students have confirmed the advantages of these courses: with the help of a readily available digital education environment, they can easily track their educational path and study the subject independently. They deny the difficulty of learning without the help of teachers and the complexity of time management, and there are usually no customization or technical issues of EC blended learning. This attitude is typical for about 3/4 of graduates and students. Therefore, LC students show a positive motivation to learn in

a digital environment. Learning autonomy and self-study, student participation and interaction are different aspects of the transition from a teacher-centered model to a student-centered model. This result contradicts the preconceived notion that graduate students find it more difficult to adapt to learning in the digital environment they face. The more challenging and critical LC students show a positive motivation to learn in a digital environment. They believe that having time to participate in courses is a necessity of modern life. They prefer and hope that this format is not the traditional full-time method. Willing to study courses at other universities, provided that their university recognizes these certificates. They disagreed that the curriculum would reduce the quality of education and make it more difficult to obtain. Most of them think that using EC can solve the problems faced by student staff. Two-thirds of students at both universities agree with the majority. This contradicts the old view that experienced Master's degree students are more skeptical of e-learning than Bachelor's degree students. On the contrary, online training is a modern trend for most people and opens up more opportunities for online training in partner universities (including foreign universities). Independent and autonomous learning, participation and interaction with students are different aspects of the transition from a teacher-centered model to a student-centered model. Usually, LC students systematically formulate course content from the beginning and immediately participate in teaching. Their answer reflects the interactive nature of the reverse classroom activity, that is, mutual assistance and interaction. It is completely consistent with the classmates and this result (Rajaram, 2019) and (Arıf and Omar, 2019). In (Sukmawati et al., 2020) and (Røe et al., 2019), students also found that the cooperation and interaction with classmates and teachers under the blended learning model was positively evaluated. Slightly less than two-thirds of students confirmed that mixed-form seminars are more intense than classic face-to-face seminars, and there are no cluster differences. Almost all LC students confirmed that they participated in the seminar, but at the same time more often they felt a lack of connection. The formation of this view is more typical among graduate students.

This situation seems controversial because blended learning means only canceling face-to-face courses, not seminars. Perhaps this reflects some extent teachers' preference for traditional face-to-face learning methods. Use them for active and interactive teaching methods, and develop differentiated reward systems for teachers. Almost all LC students find that statistical methods, data analysis, and educational research courses are both informative and useful. Given the positive attitudes of most students, including partner universities, towards digital learning and interactive tools,

this result is consistent with the results of (Islam and Sheikh, 2020) and (Wu and Chen, 2017). Finally, the attitudes of most respondents to the use of dishonesty strategies in online learning are as follows. They tend to answer questions about falsified test results and are not sure about the independence of mutual testing and tasks. They believe that no longer duration, more test attempts, or strict control during the test process will help combat students' dishonesty strategies. Most students believe that some academic's use of dishonesty strategies reflects their own life experiences, showing some kind of cynicism or disappointment, but the reason may be their own dishonest strategies. The issue of dishonest strategies requires further investigation. Learning independence, student participation, and interaction are very important because they partly reflect the success of the transition from a teacher-centered model to a student-centered model.

Bibliography

Baviskar, S. N., Hartle, R. T., & Whitney, T. (2009). Essential Criteria to Characterize Constructivist Teaching: Derived from a review of the literature and applied to five constructivist-teaching method articles. International Journal of Science Education 31 (4), 541–550. Bruner,

J. S. (1963). The Process of Education. Vintage Books, NY, Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? Educational Technology Research and Development, 53 (4), 25–39.

Forrester, J. (1961). Industrial Dynamics. Waltham, MA. Pegasus Communications. Forrester, J. (1997).

System Dynamics and K-12 Teachers. Lecture at the University of Virginia School of Education. Fosnot, C. T. (1996).

Constructivism: Theory, perspectives and practice. New York: Teachers College Press. Foster, A. (2008). Games and motivation to learn science: personal identity, applicability, relevance and meaningfulness. Journal of Interactive Learning Research, 19 (4), 597–614.

Graham, C. R., Burgoyne, N., Cantrell, P., Smith, L., St. Clair, L., & Harris R. (2009). Measuring the TPACK Confidence of Inservice Science Teachers, Tech Trends, 53 (5), 70-79. Harris, J., Mishra, P., & Koehler M. (2009).

Teachers' Technological Pedagogical Content Knowledge and Learning Activity Types: Curriculum-based Technology Integration Reframed. Journal of Research on Technology in Education, 41 (4), 393–416.

Hermans, R., Tondeur, J., van Braak, J., & Valcke, M. (2008). The impact of primary school teachers' educational beliefs on the classroom use of computer. Computers and Education, 51 (4), 1499–1509.

Higgins, S., & Moseley, D. (2001). Teachers' thinking about information and communications technology and learning: Beliefs and outcomes. Teacher Development, 5 (2), 191–210.

Honey, M., & Moeller, B. (1990). Teachers' beliefs and technology integration: Different understandings. In Technical Report Issue, 6, Washington, D.C.: Office of Educational Research and Improvement.

Inch, S. (2002). The accidental constructivist a mathematician's discovery. College

Teaching, 50 (3), 111–113.

Khine, M. S. (2001). Attitudes toward computers among teacher education students in Brunei Darussalam. International Journal of Instructional Media, 28 (2), 147–153. Koehler, M. J., & Mishra, P. (2008).

Introducing TPCK. In AACTE Committee on Innovation and Technology (Ed.), Handbook of technological pedagogical content knowledge (TPCK) for educators (pp. 3-29). New York: Routledge.

Lemke, C. (2003). Standards for a modern world: Preparing students for their future. Learning & Leading with Technology, 31 (1), 6-9.

Meluso, A., Zheng, M., Spires H. A., & Lester, J. (2012). Enhancing 5th graders' science content knowledge and self-efficacy through game-based learning. Computers & Education 59, 497–504.

Michael, J. (2006) Where's the evidence that active learning works? Advances in Physiology Education 30 (4), 159-167.

Miller, L. M., Moreno, J., Estrera, V., & Lane, D. (2004). Efficacy of MedMyst: an Internet teaching tool for middle school microbiology. Microbiology Education, 5 (1), 13–20.

Miller, L. M., Moreno, J., Willcockson, I., Smith, D., & Mayes, J. (2006). An online, interactive approach to teaching neuroscience to adolescents. CBE Life Science Education, 5 (2), 137–143.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. Teachers College Record, 108 (6), 1017-1054.

Moersch, C. (2002). Measures of success: Six instruments to assess teachers' use of technology. Learning & Leading with Technology, 30 (3), 10-13, 24.

Norris, R. S., & Kristensen, H. M. (2010). Global nuclear weapons inventories, 1945–2010. Bulletin of the Atomic Scientists, 66, 77-83.

Papastergiou, M. (2009). Digital game-based learning in high school computer science education: impact on educational effectiveness and student motivation. Computers & Education, 52, 1–12.

Perkins, D. N. (1999). The many faces of constructivism. Educational Leadership, 57 (3), 6–11. Richardson, V. (2003). Constructivist pedagogy. Teachers College Record, 105 (9), 1623–1640.

Rodriguez, A.J., & Berryman, C. (2002). Using sociotransformative constructivism to teach for understanding in diverse classrooms: A beginning teacher's journey. American Educational Research Journal, 39 (4), 1017–1045.

Sandholtz, J. H. (1997). Teaching with technology: Creating student-centered classrooms. New York, NY: Teachers College Press.

Senge, P. (1990). The Fifth Discipline: The Art and Practice of the Learning Organization.

Currency Spires, H. A. (2008). 21st century skills and serious games: preparing the N generation. In L. A. Annetta (Ed.), Serious educational games (pp. 13–23).

Rotterdam, The Netherlands: Sense Publishing Spires, H. A., Rowe, J. P., Mott, B. W., & Lester, J. C. (2011). Problem solving and game-based learning: effects of middle grade students' hypothesis testing strategies on science learning outcomes. Journal of Educational Computing Research, 44, 453–472.

Sterman, J. (2000). Business Dynamics: Systems Thinking and Modeling for a Complex World. The McGraw-Hill Companies, Inc. Vermette, P., Foote, C., Bird, C., Mesibov, D., Harris-Ewing, S., & Battaglia, C. (2001).

Understanding constructivism(s): A primer for parents and school board members.

Education, 122 (1), 87–93. Wang, L., Ertmer, A. P., & Newby, J. T. (2004). Increasing preservice teachers' self-efficacy beliefs for technology integration. Journal of Research on Technology in Education, 36 (3), 231–250.

Wilson, B. G. (Ed) (1996). Constructivist learning environments: Case studies in instructional design. Englewood Cliffs, NJ: Educational Technology Publications.

Windschitl, M. (2002). Framing constructivism in practice as the negotiations of dilemmas: An analysis of the conceptual, pedagogical, cultural and political challenges facing teachers. Review of Educational Research, 72 (2), 131–175.

Moreno and Mayer, 2007   R. Moreno, R. Mayer. Interactive multimodal learning environments: Special issue on interactive learning environments:Contemporary issues and trends. Educational Psychology Review, 19 (3) (2007), pp. 309-326,
Mayer, 2014,R.E. Mayer, Cognitive theory of multimedia learning, R.E. Mayer (Ed.), The Cambridge handbook of multimedia learning (2nd ed.), Cambridge University Press, New York, NY (2014), pp. 31-48.

Frailich et al., 2009. M. *Frailich, M. Kesner, A. Hofstein. Enhancing students' understanding of the concept of chemical bonding by using activities provided on an interactive website. Journal of Research in Science Teaching, 46 (3) (2009), pp. 289-310,

Gunbas, 2015. Students' mathematics word problem-solving achievement in a computer-based story. Journal of Computer Assisted Learning, 31 (1) (2015), pp. 78-95

Chang et al., 2008. K.-E. *Chang, Y.-L. Chen, H.-Y. Lin, Y.-T. Sung. Effects of learning support in simulation-based physics learning. Computers & Education, 51 (4) (2008), pp. 1486-1498

Buckley et al., 2004. B. *Buckley, J. Gobert, A.C.H. Kindfield, P. Horwitz, R.F. Tinker, B. Gerlits, ..., J. Willett. Model-based teaching and learning with BioLogicaTM: What do they learn? How do they learn? How do we know? Journal of Science Education and Technology, 13 (1) (2004), pp. 23-41